

**WHAT IS CLAIMED IS:**

1. A semiconductor device comprising:

a substrate in which penetrating holes are formed;

a semiconductor chip having electrodes;

a conductive member adhered on one side of said substrate  
by an adhesive material over a particular region of said one  
side including said penetrating holes, and electrically  
connected to said electrodes of said semiconductor chip on the  
side opposite to the surface of being adhered by said adhesive;  
and

external electrodes which are provided through said  
penetrating holes, electrically connected to said conductive  
member, and extending as far as outside of the other side of  
said substrate;

wherein a part of said adhesive material is interposed  
between internal wall surfaces forming said penetrating holes  
and said external electrodes within said penetrating holes.

2. The semiconductor device as defined in claim 1,

wherein a part of said adhesive material enters and exists  
within said penetrating holes.

3. A semiconductor device comprising:

a substrate in which penetrating holes are formed;

a semiconductor chip having electrodes;

a conductive member directly formed over a particular

region including said penetrating holes on one side of said substrate, and electrically connected to said electrodes of said semiconductor chip; and

external electrodes which are provided through said  
5 penetrating holes, electrically connected to said conductive member, and extending as far as outside of the other side of said substrate;

wherein said substrate is formed of a material of a higher elasticity than said external electrodes; and

10 wherein protrusions are formed in the internal wall surfaces of said penetrating holes by said material constituting said substrate.

4. The semiconductor device as defined in claim 1,

15 wherein each of said external electrodes includes a base portion positioned within each of said penetrating holes and a projecting portion projecting from each of said penetrating holes, the diameter d of said base portion being related to the diameter  $\phi$  of said projecting portion by  $\phi \leq d$ .

20

5. The semiconductor device as defined in claim 3,

wherein each of said external electrodes includes a base portion positioned within each of said penetrating holes and a projecting portion projecting from each of said penetrating  
25 holes, the diameter d of said base portion being related to the diameter  $\phi$  of said projecting portion by  $\phi \leq d$ .

6. A semiconductor device comprising:

a substrate in which penetrating holes are formed;

a semiconductor chip having electrodes;

a conductive member adhered on one side of said substrate

5 by an adhesive material over a particular region of said one side including said penetrating holes, and electrically connected to said electrodes of said semiconductor chip on the side opposite to the surface of being adhered by said adhesive; and

10 external electrodes which are provided through said penetrating holes, electrically connected to said conductive member, and extending as far as outside of the other side of said substrate;

15 wherein each of said external electrodes includes a base portion positioned within each of said penetrating holes and a projecting portion projecting from each of said penetrating holes, the diameter  $d$  of said base portion being related to the diameter  $\phi$  of said projecting portion by  $\phi \leq d$ .

20 7. The semiconductor device as defined in claim 1, wherein said substrate is an insulating substrate.

8. The semiconductor device as defined in claim 3, wherein said substrate is an insulating substrate.

25

9. The semiconductor device as defined in claim 6, wherein said substrate is an insulating substrate.

10. The semiconductor device as defined in claim 1,  
wherein said substrate is a printed substrate.

11. The semiconductor device as defined in claim 3,  
5 wherein said substrate is a printed substrate.

12. The semiconductor device as defined in claim 6,  
wherein said substrate is a printed substrate.

10 13. The semiconductor device as defined in claim 1,  
wherein said external electrodes are formed of solder.

14. The semiconductor device as defined in claim 3,  
wherein said external electrodes are formed of solder.

15 15. The semiconductor device as defined in claim 6,  
wherein said external electrodes are formed of solder.

16. The semiconductor device as defined in claim 1,  
20 wherein the outline form of said substrate is larger than  
the semiconductor chip outline form.

17. The semiconductor device as defined in claim 3,  
wherein the outline form of said substrate is larger than  
25 the semiconductor chip outline form.

18. The semiconductor device as defined in claim 6,

wherein the outline form of said substrate is larger than the semiconductor chip outline form.

19. The semiconductor device as defined in claim 1,

wherein said electrodes of said semiconductor chip are electrically connected to said conductive member through an anisotropic conductive material having conductive particles dispersed in an adhesive.

20. The semiconductor device as defined in claim 3,

wherein said electrodes of said semiconductor chip are electrically connected to said conductive member through an anisotropic conductive material having conductive particles dispersed in an adhesive.

21. The semiconductor device as defined in claim 6,

wherein said electrodes of said semiconductor chip are electrically connected to said conductive member through an anisotropic conductive material having conductive particles dispersed in an adhesive.

22. The semiconductor device as defined in claim 1,

wherein said electrodes of said semiconductor chip are electrically connected to said conductive member through wires.

23. The semiconductor device as defined in claim 3,

wherein said electrodes of said semiconductor chip are

electrically connected to said conductive member through wires.

24. The semiconductor device as defined in claim 6,

wherein said electrodes of said semiconductor chip are

electrically connected to said conductive member through wires.

25. A circuit board on which is mounted the semiconductor device as defined in claim 1.

26. A circuit board on which is mounted the semiconductor device as defined in claim 3.

27. A circuit board on which is mounted the semiconductor device as defined in claim 6.

28. An electronic instrument having the circuit board as defined in claim 25.

29. An electronic instrument having the circuit board as defined in claim 26.

30. An electronic instrument having the circuit board as defined in claim 27.

31. A method of manufacturing a semiconductor device, comprising:

a step of providing a substrate with an adhesive material

provided on one surface thereof;

a step of carrying out punching from the side of said substrate on which said adhesive material is provided, and in the direction of the opposite side thereof, whereby penetrating  
5 holes are formed and a part of said adhesive material is drawn into said penetrating holes;

a step of adhering a conductive member over a particular region on said one surface including said penetrating holes on said substrate through said adhesive material;

10 a step of providing a material for forming external electrodes on said conductive member, and forming external electrodes through said penetrating holes and the inner side of said part of adhesive material drawn into the penetrating holes to project from the surface opposite to the surface of  
15 said substrate on which said conductive member is formed; and

a step of electrically connecting electrodes of a semiconductor chip to said conductive member.

32. A method of manufacturing a semiconductor device,  
20 comprising:

a step of providing a substrate of a material of a higher elasticity than external electrodes, having penetrating holes in which the internal wall surfaces have protrusions, and having a conductive member directly formed over a region including said  
25 penetrating holes;

a step of providing a material for forming external electrodes on said conductive member, and forming external

electrodes through said penetrating holes to project from the surface opposite to the surface of said substrate on which said conductive member is formed; and

5 a step of electrically connecting electrodes of a semiconductor chip to said conductive member.

33. The method of manufacturing a semiconductor device as defined in claim 32, further comprising:

10 a step of punching said substrate before said conductive member is formed, wherein a part of said substrate is drawn into said penetrating holes and said protrusions are formed.

34. The method of manufacturing a semiconductor device as defined in claim 32,

15 wherein said penetrating holes are formed by a laser.

35. The method of manufacturing a semiconductor device as defined in claim 32,

20 wherein said penetrating holes are formed by wet etching.

36. The method of manufacturing a semiconductor device as defined in claim 31,

25 wherein each of said external electrodes includes a base portion positioned within each of said penetrating holes and a projecting portion projecting from each of said penetrating holes, the diameter  $d$  of said base portion being related to the diameter  $\phi$  of said projecting portion by  $\phi \leq d$ .



37. The method of manufacturing a semiconductor device as defined in claim 32,

wherein each of said external electrodes includes a base portion positioned within each of said penetrating holes and a projecting portion projecting from each of said penetrating holes, the diameter  $d$  of said base portion being related to the diameter  $\phi$  of said projecting portion by  $\phi \leq d$ .

38. A method of manufacturing a semiconductor device, comprising:

a step of providing a substrate in which penetrating holes are formed and a conductive member is formed over a region including said penetrating holes;

a step of providing a material for forming external electrodes on said conductive member, and forming external electrodes through said penetrating holes to project from the surface opposite to the surface of said substrate on which said conductive member is formed; and

a step of electrically connecting electrodes of a semiconductor chip to said conductive member;

wherein each of said external electrodes includes a base portion positioned within each of said penetrating holes and a projecting portion projecting from each of said penetrating holes, the diameter  $d$  of said base portion being related to the diameter  $\phi$  of said projecting portion by  $\phi \leq d$ .

39. The method of manufacturing a semiconductor device as

defined in claim 31,

wherein said substrate is either of an insulating film and a printed substrate.

5 40. The method of manufacturing a semiconductor device as defined in claim 32,

wherein said substrate is either of an insulating film and a printed substrate.

10 41. The method of manufacturing a semiconductor device as defined in claim 31, wherein said material for forming external electrodes is solder.

15 42. The method of manufacturing a semiconductor device as defined in claim 32, wherein said material for forming external electrodes is solder.

20 43. The method of manufacturing a semiconductor device as defined in claim 38, wherein said material for forming external electrodes is solder.

44. The method of manufacturing a semiconductor device as defined in claim 31, further comprising:

25 a step of punching said substrate around said semiconductor chip, after the step of electrically connecting electrodes of said semiconductor chip to said conductive member.

45. The method of manufacturing a semiconductor device as defined in claim 32, further comprising:

a step of punching said substrate around said semiconductor chip, after the step of electrically connecting electrodes of said semiconductor chip to said conductive member.

46. The method of manufacturing a semiconductor device as defined in claim 38, further comprising:

a step of punching said substrate around said semiconductor chip, after the step of electrically connecting electrodes of said semiconductor chip to said conductive member.

47. The method of manufacturing a semiconductor device as defined in claim 31,

wherein in the step of electrically connecting said electrodes of said semiconductor chip to said conductive member, said electrodes are connected to said conductive member through an anisotropic conductive material having conductive particles dispersed in an adhesive.

48. The method of manufacturing a semiconductor device as defined in claim 32,

wherein in the step of electrically connecting said electrodes of said semiconductor chip to said conductive member, said electrodes are connected to said conductive member through

an anisotropic conductive material having conductive particles dispersed in an adhesive.

49. The method of manufacturing a semiconductor device as  
5 defined in claim 38,

wherein in the step of electrically connecting said  
electrodes of said semiconductor chip to said conductive member,  
said electrodes are connected to said conductive member through  
an anisotropic conductive material having conductive particles  
10 dispersed in an adhesive.

50. The method of manufacturing a semiconductor device as  
defined in claim 31,

wherein in the step of electrically connecting said  
15 electrodes of said semiconductor chip to said conductive member,  
said electrodes are connected to said conductive member through  
wires.

51. The method of manufacturing a semiconductor device as  
20 defined in claim 32,

wherein in the step of electrically connecting said  
electrodes of said semiconductor chip to said conductive member,  
said electrodes are connected to said conductive member through  
wires.

52. The method of manufacturing a semiconductor device as  
25 defined in claim 38,

wherein in the step of electrically connecting said electrodes of said semiconductor chip to said conductive member, said electrodes are connected to said conductive member through wires.